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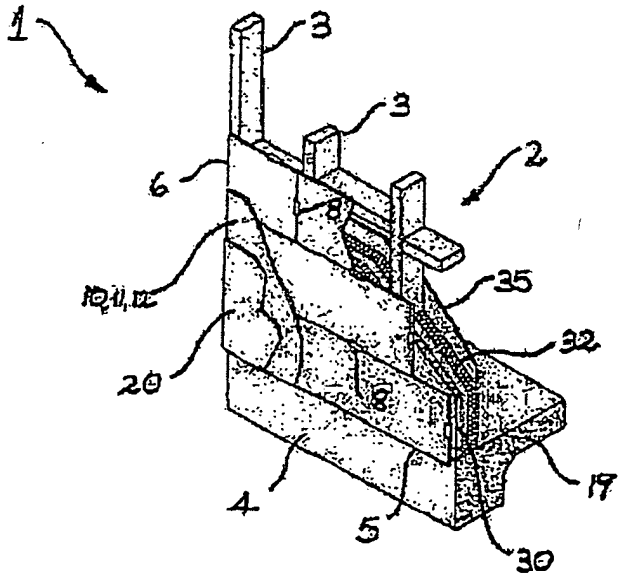
(54) Title: WALL CONSTRUCTION METHOD



(57) Abstract: A method for forming a composite wall (1), said method including the steps of: erecting frame (2) including a plurality of generally upright spaced apart studs (3); positioning a plurality of external cladding sheets (4) over the frame in a generally horizontal orientation such that a majority of the cladding sheets extend across two or more of the studs; fastening the sheets (4) to the frame in substantially contiguous abutting relationship to form a generally planar substrate for a wall; and applying a surface render (10, 12) including a reinforcing mesh (11) substantially uni formly over the substrate; thereby to form a structural wall with an external appearance of rendered masonry without the need for supplementary internal rendering, bracing or reinforcement.

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TITLE: WALL CONSTRUCTION METHOD

FIELD OF THE INVENTION

The present invention relates to a method of housing construction.

The invention has been developed primarily for use in the construction of walls, in domestic dwellings, and will be described primarily with reference to this application. It will be appreciated, however, that the invention is not limited to this particular field of uses, being readily adaptable to the fabrication of floors, ceilings and other generally planar surfaces, not only in residential dwellings but also in commercial and industrial environments.

BACKGROUND OF THE INVENTION

Any discussion of the prior art throughout the specification should in no way be considered as an admission that such prior art is widely known or forms part of common general knowledge in the field.

One building construction techniques currently in widespread use for residential dwellings, involves initially fabricating a structural frame, usually from timber or metal, and applying an external veneer or skin to the frame. One preferred type of veneer is formed from a single layer of bricks and mortar. This has the advantage of providing the outward appearance of "double brick" construction but at considerably lower cost. Nevertheless, even "brick veneer" and similar types of masonry construction are relatively time-consuming and expensive to implement. A further disadvantage with basic brick veneer construction is that there is little scope for varying the external appearance of the brick work to suit different architectural styles and personal tastes.

In an attempt to provide greater aesthetic diversity, various masonry render systems, such as "stucco" render, have been developed. These have the advantage of providing a solid "monolithic" appearance. They also provide a greater degree of flexibility in terms of surface texture, colour and finish, while preserving the desirable impression of substance and solidity, characteristic of masonry construction. Typically, however, these systems require special expertise to apply effectively, add further to the time and cost of construction, and can be prone to other problems such as sagging, delamination and environmental degradation.

In an attempt to address some of these problems, other cladding systems have also been developed including various forms of aluminium cladding, vinyl cladding, fibre cement sheeting, corrugated steel sheeting, weatherboarding, and the like. These systems are typically less expensive than masonry - particularly rendered masonry -

construction, and are more or less functional at a base level. Depending upon the particular material concerned, however, in most cases these systems are either less durable, less flexible in terms of surface finishes, less well insulated, have lower strength characteristics, or lack the desired appearance of substance and solidity associated with rendered masonry construction.

In an attempt to address these deficiencies, the present applicant previously developed a system whereby fibre reinforce cement (FRC) sheets were applied to a building frame and rendered externally in order to conceal the joins between the sheets. However, this system was subject to its own disadvantages. In particular, in order to provide the requisite class A bracing, internal reinforcement was required. This usually took the form of a layer of back render applied by spraying over the internal surfaces of the cladding sheets between the studs, or supplementary internal bracing. In either case, this added considerably to the time and cost of construction, but was believed to be essential in order to provide the requisite degree of rigidity and structural integrity for the composite wall. This system also required adjacent sheets to be joined over the tops of the framing studs, which again added to the construction time, and gave rise to significant material wastage in the form of off-cuts.

Other problems that arose with some known render systems used in conjunction with FRC sheeting were the visibility of the joins through the render which allowed the underlying sheets to be "read" in certain lighting conditions, as well as problems of cracking in the render, particularly in the vicinity of the joins.

It is an object of the present invention to overcome or substantially ameliorate one or more of these disadvantages of the prior art, or at least to provide a useful alternative.

SUMMARY OF THE INVENTION

Accordingly, the invention provides a method for forming a composite wall, said method including the steps of:-

erecting a frame including a plurality of generally upright spaced apart studs;

positioning a plurality of external cladding sheets over the frame in a generally horizontal orientation such that a majority of the cladding sheets extend across two or more of the studs;

fastening the sheets to the frame in substantially contiguous abutting relationship to form a generally planar substrate for a wall; and

applying a surface render including a reinforcing mesh substantially uniformly over the substrate;

thereby to form a structural wall with an external appearance of rendered masonry without the need for supplementary internal rendering, bracing or reinforcement.

Preferably, the frame is formed substantially from timber. It should be appreciated, however, that framing formed from metal or other suitable materials may alternatively be used. The studs are preferably spaced apart at approximately 450 millimetre centres.

Preferably, the external cladding sheets are formed from fibre reinforce cement (FRC). The FRC sheets are preferably between 4 millimetres and around 20 millimetres, more preferably between 6 mm and around 10 millimetres, and ideally between 7 and 8 millimetres in thickness.

Preferably, the external cladding sheets are substantially rectangular in shape, having a pair of substantially parallel longitudinal sides, and a pair of substantially parallel ends. Most preferably, the sheets are approximately 2.4 m long, approximately 0.45 m wide and approximately 7.5 millimetres thick, with a density of around 10 kg/m. It will be appreciated, however, that the dimensions may vary according to the material properties of the cladding sheets, the configuration of the framing elements, and the particular applications in which they are employed.

In the preferred embodiment, the elongate cladding sheets are applied to the frame in an horizontally oriented staggered or "brick-like" pattern, with the longitudinal edges of the sheets extending substantially perpendicularly across the framing studs.

Preferably, the outer surface of each FRC cladding sheet is roughened to facilitate mechanical and chemical bonding to the surface render. Preferably also, each building sheet includes at least one square edge such that adjacent building sheets can abut one another with minimal visibility at the join. More preferably, each edge of each building sheet is substantially square to facilitate flush jointing and finishing with compatible jointing and finishing systems.

Ideally, the building sheets are positioned such that the mating ends of adjoining sheets are joined with one another over the top of an underlying stud. One unexpected advantage of the present invention, however, is that "off-stud joining" of sheets is possible without compromising the dimensional stability or structural integrity of the wall. In that case, however, special-purpose "off-stud joiners" are preferably used to tie

the ends of the abutting sheets together. This helps to stabilise the vertical and horizontal edges of the sheets where unsupported during rendering, and also helps to prevent subsequent cracking in the render mix.

Another unexpected advantage of the invention is that a layer of back render on the reverse side of the building sheets is not required, although back render may be applied if desired.

Preferably, however, where back-render is not applied to the inside surfaces of the building sheets between the studs, back priming is applied by brush, roller or spray to all exposed surfaces of the fibre cement sheets.

Preferably, the reinforcing mesh is formed substantially from fibreglass, and is applied over the top of a first levelling coat of render. Ideally, any joins in the fibreglass mesh are formed with a minimum overlap of around 50 millimetres.

Preferably, the render is a high-build render, formed from an acrylic-modified cementitious material designed to be screeded to a flat level finish when applied externally to a vertical surface. The render is preferably applied to a depth sufficient to eliminate the possibility for sheet "read" in any normal lighting conditions.

Preferably also, the method includes the further step of applying a selected texture finish to the render in order to achieve the desired aesthetic impression. Most preferably, a high-quality acrylic texture membrane paint is also applied, either to the texture finish, or to the render if a separate texture finish is not used.

Preferably, a thermal insulation material is installed on the inside of the building sheets, between the studs, and the wall cavity is then preferably closed by means of an internal lining material such as plasterboard. Any suitable installation material may be used including rock wool, glass wool or polyester batts.

Preferably also, a layer of suitable flashing, ideally in the form of a vapour permeable sarking material is applied between the inner surfaces of the building sheets and the adjacent insulation, to provide optimal waterproofing characteristics.

In the preferred embodiment, a finishing strip, ideally formed from the aluminised stainless steel or PVC, is installed to provide a straight edge to the finishing layers, and to protect the sheet edges at the top and bottom of the wall.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

figure 1 is a diagrammatic cutaway perspective view showing a composite wall formed in accordance with the method of the present invention;

figure 2 is a diagrammatic cross-sectional view showing the wall system of figure 1 applied to a double story construction, with back-render applied to the lower level, and omitted in the upper level;

figure 2(a) is an enlarged detail of the upper storey wall section of figure 2;

figure 3 is a plan view showing the application of cladding or building sheets to the vertical framing studs in an horizontally oriented, staggered or "brickwork" type pattern such that the sheets extend across multiple studs;

figure 4 is a plan view similar to figure 3, showing the installation of the building sheets around a window opening and the use of PVC off-stud joiners;

figures 5(a) and 5(b) are enlarged perspective views showing the off-stud joiners in more detail;

figures 6(a) and 6(b) are enlarged perspective views showing complementary interlocking edge formations in the building sheets, as an alternative to the off-stud joiners of figure 5;

figures 7(a) and 7(b) are vertical cross-sections showing the installation of horizontal control joints, to accommodate expansion and contraction of the building sheets;

figure 7 (c) is an horizontal cross-section showing the installation of a vertical control joint;

figure 8 is a vertical cross-section showing the finishing detail of the wall adjacent the edge of an underlying concrete slab, including an horizontal control joint extending along the slab edge;

figures 9(a), 9(b) and 9(c) are vertical cross-sections showing a series of alternative methods for finishing and integrating the wall into a window reveal or sill; and

figure 10 is an horizontal section showing an external corner detail of the wall.

PREFERRED EMBODIMENT OF THE INVENTION

Referring initially to figures 1 and 2, the invention provides a method for forming a composite wall 1. The first stage in the process involves erecting a structural frame 2 including a series of generally upright studs 3 spaced part at approximately 450 millimetre centres. The frame is preferably formed from timber, but may alternatively be formed from metal or other suitable framing materials.

The next stage of the process involves positioning a plurality of building or cladding sheets 4 over the frame in a generally horizontal orientation, such that at least a majority of the cladding sheets extend across multiple studs. The sheets are ideally staggered in a brickwork type configuration, which may be regular or irregular, as shown in figure 3. Figure 4 is similar, but shows a typical installation of the sheets around an opening, such as a window or door. In cases such as this, the staggering is preserved as far as possible.

In the preferred form of the invention, the building sheets are formed from fibre reinforced cement (FRC). The FRC sheets are preferably between 4 and around 20 millimetres, more preferably between 6 and around 10 millimetres, and ideally around 7.5 millimetres in thickness. Most conveniently, the sheets are rectangular in shape, having a parallel pair of longitudinal sides 5, and a parallel pair of ends 6, substantially shorter in length than the sides. In one preferred system, the longitudinal sides 5 are 2.4 metres in length, and the ends are 0.45 metres in width, corresponding approximately to the stud spacing. The density of the FRC sheet is preferably between 8 and 12 kg/m^2, and ideally around 10 kg/m^2. The sheets are fastened to the underlying studs using nails from a nail gun, or alternatively by screwing, tacking, riveting, gluing or other suitable fastening means.

One unexpected and benefit of the construction technique according to the present invention is that the ends of abutting sheets do not need to be joined over the tops of the studs (a technique known as "on-stud joining"). Advantageously, off-stud joining is possible without compromising the structural integrity of the finished wall. In that case, however, it is preferred that special-purpose off-stud joiners 8 are used to tie the ends and/or the sides of abutting sheets together. These joiners and take the form of elongate PVC strips having an "H "shaped cross-sectional profile, as best illustrated in figures 5(a) and 5(b). These help to stabilise the vertical and horizontal edges of the sheets where unsupported by underlying studs, particularly during the subsequent process steps. An alternative form of stud stabilisation is shown in figures, 6(a) and 6(b). In this case, separate off-stud joiners are not used. Rather, the sheets are formed with complementary edge profiles 9, such as interlocking tongue and groove formations, adapted to resist relative movement, and in particular co-planar misalignment, between abutting sheets along the joins.

The next major step in the construction process involves the application of an initial levelling layer 10 of cementitious render over the outer surfaces of the building

sheets 4, so as to substantially cover the sheets and the intermediate join lines. This initial layer is ideally several millimetres in thickness as best seen in figure 2(a). Advantageously, the outer surfaces of the building sheets are pre-roughened to enhance the bond strength between the render and the underlying FRC substrate.

A layer of reinforcing mesh 11 is then applied to the surface of the initial levelling layer 10 of render, while the render is still wet. Ideally, fibreglass reinforcing mesh is used. Again, however, other suitable materials may be substituted. Most conveniently, the mesh is initially cut into squares with a side length of around 1 m, to facilitate handling in readily manageable sections. Where the mesh is applied in sections, however, an overlap of at least 50 millimetres between adjacent sections is ideally provided.

With the reinforcing mesh 11 thus in place, an outer covering layer 12 of render is applied in sufficient thickness to fully embed and conceal the mesh. The combined thickness of the render layers 10 & 12, incorporating the embedded reinforcing mesh 11, is preferably between 5 and 15 millimetres, and ideally around 7 to 8 mm. The final thickness may vary to accommodate variations in the substrate, and to suit the particular render formulation and the application in which it is used. Ideally, however, the render is applied to a depth sufficient to eliminate the possibility of sheet "read" in any normal lighting conditions, thereby ensuring the desired "monolithic" appearance of rendered masonry.

The material used for the render is ideally formed from an acrylic-modified cementitious high build material, adapted to be screeded to a flat level finish when applied externally. The two render layers are typically of the same formulation, although it will be appreciated that different formulations may be used in different layers for specific purposes. Additional layers of the same or different composition may also be used.

Horizontal control joints 13 are incorporated, as shown in figures 7(a) and (b). These are formed using longitudinally extending PVC control joint extrusions 14, ideally overlying a framing member such as a top plate 15. These joints prevent cracking of the render due to differential expansion and contraction of the underlying building sheets.

It is also preferred that vertical control joints 16 are provided at a maximum horizontal spacing of 4.8 metres between centres, as shown in figure 7(c). Where possible, vertical control joints are located behind downpipes or adjacent window or door openings. These control joints are formed by initially fixing a waterproof

membrane 17 to the frame, and then applying a suitable tape over the "V" in the membrane. The sheets are then installed, leaving a minimum gap between the ends of approximately 6 millimetres, which is ideally not filled with render. Figure 8 shows a technique for incorporating an horizontal control joint 13 directly below a ground floor finishing strip 18 adjacent the edge of a concrete slab 19.

The next step, which is optional but desirable, involves the application of a layer of texture finish 20 to the render in order to create different external aesthetic impressions. One preferred texture coating is finished to simulate the appearance of traditional stucco plaster.

In the preferred form of the invention, finishing strips 18, ideally formed from aluminised stainless steel or PVC, are installed (as best seen in figure 8), to provide a straight edge to the finishing layers, and protect the edges of the building sheets and the render at the top and bottom of the wall.

Finally, a layer of high-quality acrylic texture membrane paint 25 is also applied (see figure 2(a)), either to the texture finish, or to the render if a separate texture finish is not used. This allows a greater variety in colour selection, while enhancing water and weather protection and resisting environmental degradation.

If desired, a layer of back render 30 may also be applied to the internal surfaces of the building sheets, between the studs. This is shown, for example, in the lower story wall construction in figures 2 and 8. Where optionally employed in this way, the back render provides additional strength, thermal and acoustic insulation, and an increased impression of solidity. One of the principal advantages of the present invention, however, flows from the unexpected realisation that a layer of back render, or supplementary support or bracing of any other kind, is not required.

The system with the back render omitted is shown by way of comparison, in the upper storey section of the wall in figure 2. In that case, the wall cavity between the studs is simply filled with a layer of insulation material 32 such as rock wool, glass wool or polyester batts. The cavity is then closed from the inside using conventional internal lining materials such as plasterboard sheet 35. In situations where back render is not applied, and the inside surfaces of the building sheets are otherwise exposed, it is also desirable to seal the inside surfaces of the sheets using a suitable primer or sealer, which may be applied by brushing, rolling or spraying.

Finishing the system off in a consistent and aesthetically pleasing manner around window and door openings can be readily achieved using a variety of techniques. By

way of example, figures 9(a) 9(b) and 9(c) show three different methods for forming window reveals and sills 38 using complementary aluminium extruded sections 40, which are aesthetically integrated by the final texture finish and paint coats.

Corners may similarly be finished in a variety of ways. By way of example, figure 10 shows one such method, wherein protective metal angle sections 45 are fitted over each external corner 46, while the internal corners 47 are finished with flashing 48 to ensure adequate weatherproofing.

The method of wall construction according to the present invention provides a number of advantages over the prior art. It affords the aesthetics and durability of rendered masonry construction, while offering significantly faster construction time and significantly lower material costs. Furthermore, the system is easier to apply, and less prone to surface cracking and delamination than most previously known render systems.

Perhaps most significantly, the present invention flows from the unexpected realisation, only appreciated by the applicant as a result of extensive research, development and testing, that the combination of method steps as defined is sufficient in itself to achieve the equivalent of "Type A Structural Bracing" (an Ultimate Limit State (ULS) Bracing Capacity of at least 3.3 kN/m) as outlined in AS1684 *Residential Timber-Frames Construction* code, in walls up to at least three metres in height, without the need for supplementary internal bracing, or the application of back render to the inner surfaces of the sheets. Hitherto, such supplementary bracing or back rendering was believed to be essential in construction methods of this type in order to achieve the requisite degree of strength, rigidity and durability. In their implementation, previously known methods necessarily entailed additional construction processes, material costs, and specialised expertise, the need for which is obviated by the present invention. Accordingly, the invention represents an unexpected, yet practical and commercially significant improvement over prior art.

Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

CLAIMS

1. A method for forming a composite wall, said method including the steps of:-

erecting a frame including a plurality of generally upright spaced apart studs;

positioning a plurality of external cladding sheets over the frame in a generally horizontal orientation such that a majority of the cladding sheets extend across two or more of the studs;

fastening the sheets to the frame in substantially contiguous abutting relationship to form a generally planar substrate for a wall; and

applying a surface render including a reinforcing mesh substantially uniformly over the substrate;

thereby to form a structural wall with an external appearance of rendered masonry without the need for supplementary internal rendering, bracing or reinforcement.

2. A method according to claim 1 wherein the frame is formed substantially from timber.

3. A method according to claim 1, wherein the frame is formed substantially from metal.

4. A method according to any one of claims 1 to 3, wherein the studs are spaced apart at centres of between 300 and around 600 mm.

5. A method according to claim 4, wherein the studs are spaced apart at approximately 450 millimetre centres.

6. A method according to any one of claims 1 to 5, wherein the external cladding sheets are formed from fibre reinforce cement (FRC).

7. A method according to claim 6, wherein the FRC sheets are between 4 millimetres and around 20 millimetres in thickness.

8. A method according to claim 6 or claim 7, wherein the FRC sheets are between 6 millimetres and around 10 millimetres in thickness.

9. A method according to any one of claims 6 to 8, wherein the FRC sheets are between 7 millimetres and around 8 millimetres in thickness.

10. A method according to any one of the preceding claims, wherein the external cladding sheets are substantially rectangular in shape, having a pair of substantially parallel longitudinal sides, and a pair of substantially parallel ends.

11. A method according to claim 10, wherein the sheets are approximately 2.4 m long, approximately 0.45 m wide and approximately 7.5 millimetres thick.

12. A method according to claim 10 or claim 11, wherein the sheets have a density of between 8 and around 10 kg/m.

13. A method according to any one of claims 10 to 12, wherein the elongate cladding sheets are applied to the frame in an horizontally oriented staggered or "brick-like" pattern, with the longitudinal edges of the sheets extending generally perpendicularly across the framing studs.

14. A method according to any one of the preceding claims, including a further step of a roughening the outer surface of each cladding sheet to facilitate mechanical and chemical bonding to the surface render.

15. A method according to any one of the preceding claims, including the further step of providing at least one square edge on each building sheet, such that adjacent building sheets can abut one another with minimal visibility at the join.

16. A method according to any one of the preceding claims, wherein each edge of each building sheet is formed so as to be substantially square, thereby to facilitate flush jointing and finishing with compatible jointing and finishing systems.

17. A method according to any one of the preceding claims, wherein the building sheets are positioned such that the mating ends of at least one pair of adjoining sheets are joined over the top of an underlying stud.

18. A method according to any one of the preceding claims, wherein the building sheets are positioned such that the mating ends of at least one pair of adjoining sheets are joined off-stud.

19. A method according to claim 18, including the further step of tying the abutting ends of at least one pair of building sheets together at an off-stud joint by means of an off-stud joining formation.

20. A method according to claim 19, wherein the off-stud joining formation has a generally H-shaped cross-sectional profile.

21. A method according to claim 18, wherein the sheets are formed with complementary longitudinally extending interlocking edge profiles, adapted to resist relative movement, and in particular co-planar misalignment, between abutting sheets along the joins.

22. A method according to any one of the preceding claims, wherein the step of applying the surface render incorporates the sequential sub-steps of:-

applying an initial levelling layer of cementitious render over the outer surfaces of the building sheets, so as to substantially cover the sheets and intermediate join lines;

applying the layer of reinforcing mesh to the surface of the levelling layer while the render is still wet; and

applying an outer covering layer of render in sufficient thickness to fully embed and conceal the mesh.

23. A method according to claim 22, wherein a combined thickness of the render layers, incorporating the embedded reinforcing mesh, is between 5 and around 15 millimetres. and ideally around 7 to 8 mm.

24. A method according to claim 22 or claim 23, wherein a combined thickness of the render layers, incorporating the embedded reinforcing mesh, is between 7 and around 8 millimetres.

25. A method according to any one of the preceding claims, wherein the reinforcing mesh is formed substantially from fibreglass.

26. A method according to any one of the preceding claims, wherein the mesh is applied such that any joins are formed with a minimum overlap of around 50 millimetres.

27. A method according to any one of the preceding claims, a wherein the render is a high-build render.

28. A method according to any one of the preceding claims, wherein the render is formed from an acrylic-modified cementitious material adapted to be screeded to a flat level finish when applied externally to a vertical surface.

29. A method according to any one of the preceding claims, wherein the render is applied to a depth sufficient to eliminate the possibility for sheet "read" by the un-aided eye in normal lighting conditions.

30. A method according to any one of the preceding claims, including the further step of applying a selected texture finish to the render in order to achieve a particular desired aesthetic impression.

31. A method according to any one of the preceding claims, including the further step of applying an acrylic texture membrane paint as an outer-most protective layer.

32. A method according to any one of the preceding claims, including the further step of applying a layer of back-render on reverse sides of the building sheets, intermediate the framing studs.

33. A method according to any one of the preceding claims, including the further step of applying a layer of back-primer to exposed surfaces on reverse sides of the fibre cement sheets.

34. A method according to any one of the preceding claims, including the further step of installing a thermal insulation material on the inside of the building sheets, between the studs.

35. A method according to any one of the preceding claims, including the further step of applying a layer of suitable flashing material over the inner surfaces of the building sheets.

36. A method according to claim 35, wherein the flashing takes the form of a vapour permeable sarking material.

37. A method according to any one of the preceding claims, including the further step of closing the wall cavity by means of an internal lining material.

38. A method according to any one of the preceding claims, including the step of installing a finishing strip to provide a substantially straight edge to the finishing layers, and to protect the sheet edges at the top and bottom of the wall.

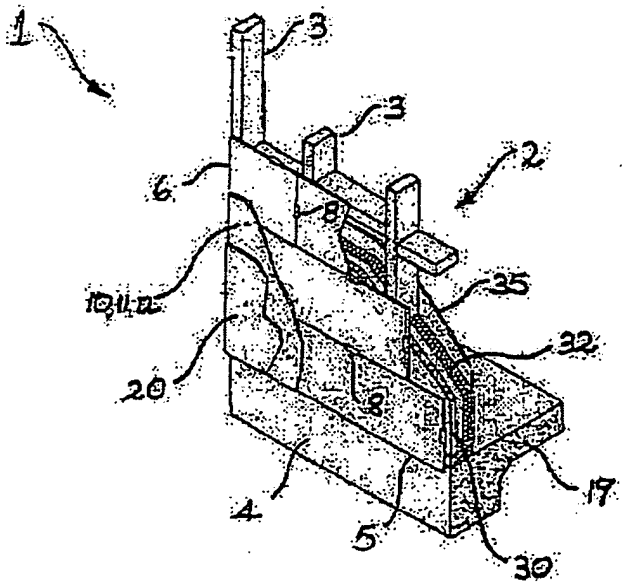


Figure 1

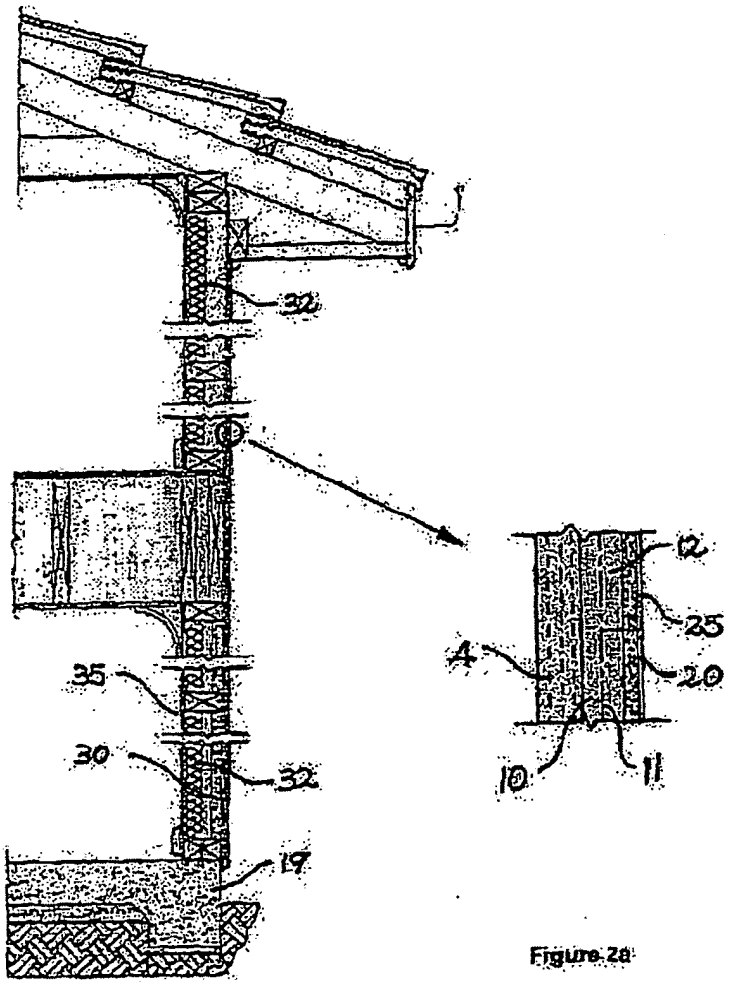


Figure 2a

Figure 2

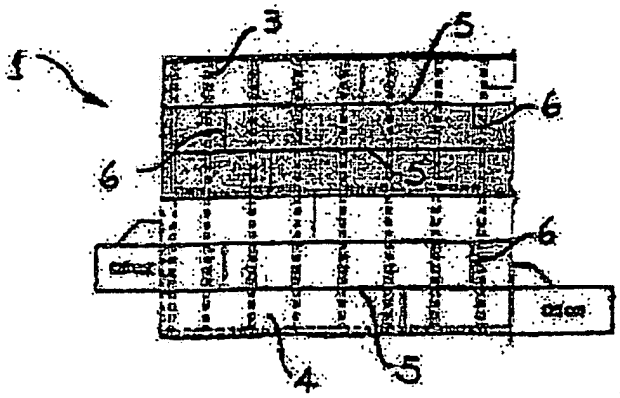


Figure 3

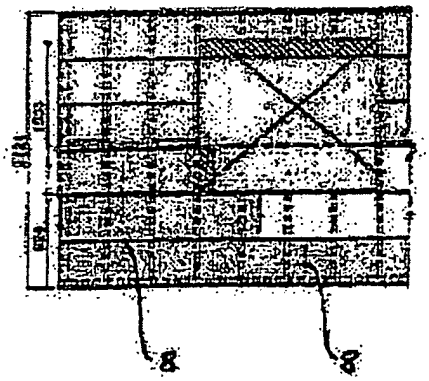


Figure 4

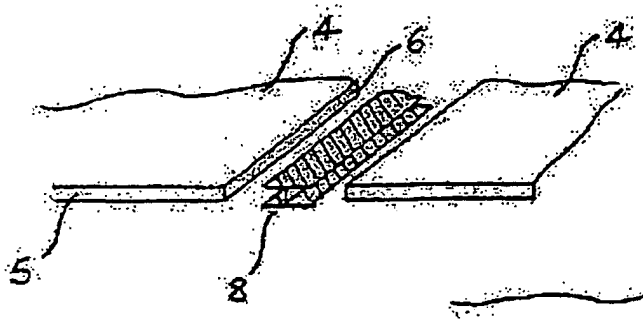


FIGURE 5a

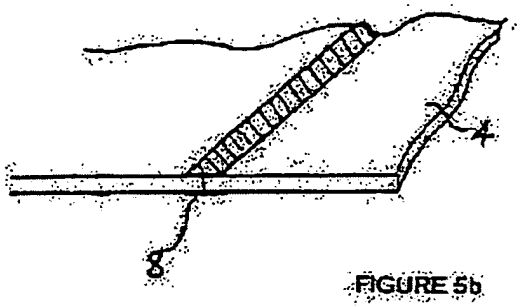


FIGURE 5b

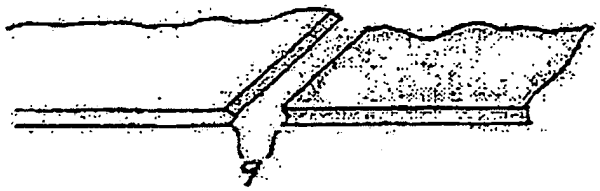


FIGURE 6a

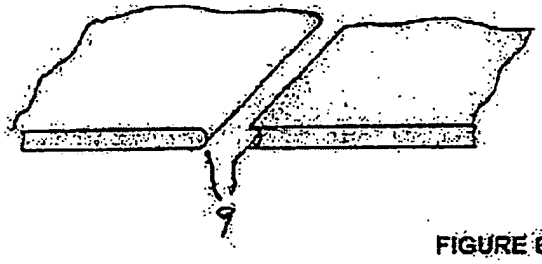
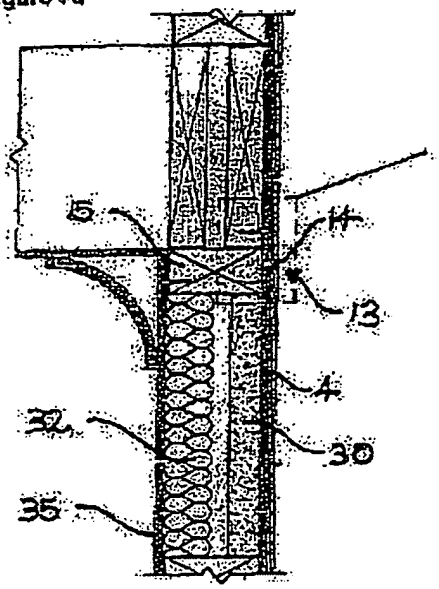
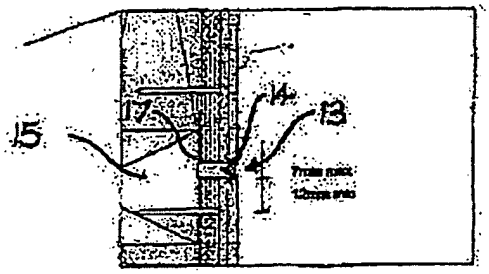


FIGURE 6b

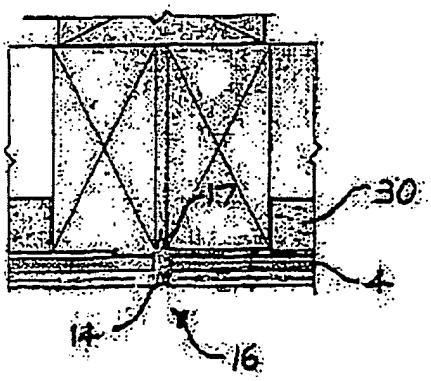
Figure 7a





igure 7b

Figure 7c



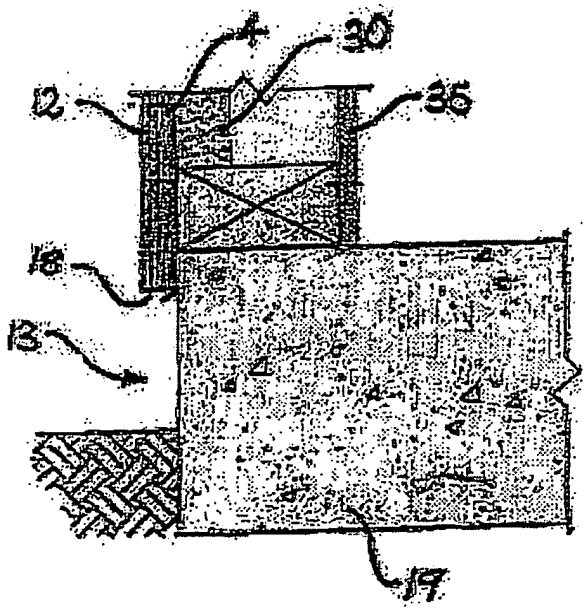


FIGURE 8

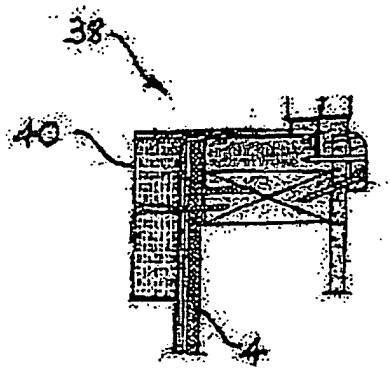


Figure 9a

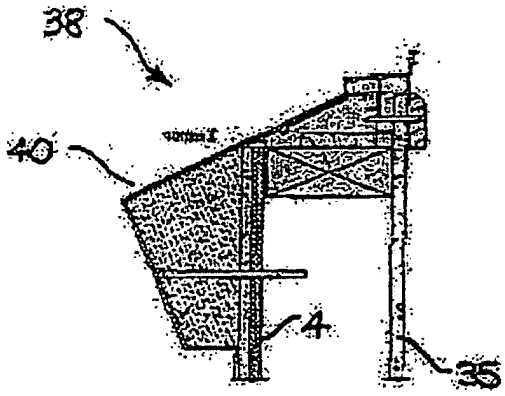


Figure 9b

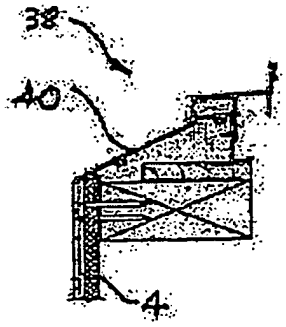


Figure 9c

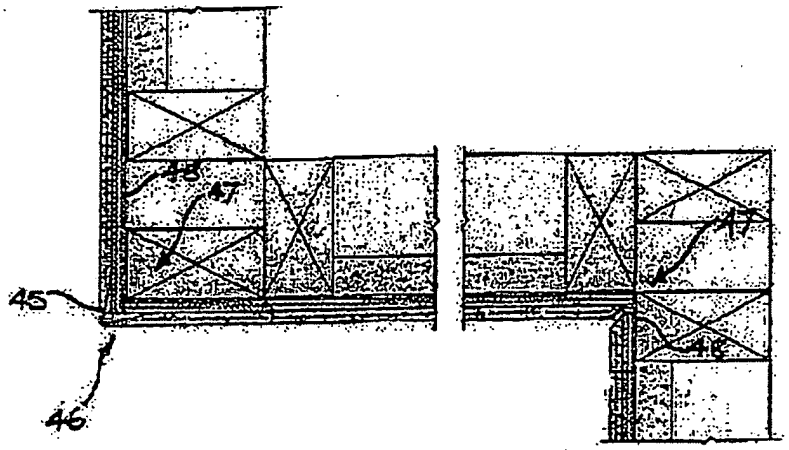


FIGURE 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU02/01416

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: E04F 13/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
REFER ELECTRONIC DATA BASE CONSULTED BELOW

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC E04F 13/04, 13/02

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI: keywords; wall, clad, sheet, lining, panel, board, covering, FRC, reinforc, strength, mesh, grid, net, fibreglass, fiberglass, render, plaster, stucco, mortar, cement, fram, stud, etc.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 16406/00 A1 (BUFALO) 17 August 2000 See figure.	1-20, 22-38
X	CA 2136778 A1 (CAMPACCI et al) 29 May 1996 See claim 7.	1-20, 22-38
X	DE 3206163 A1 (KECK) 1 September 1983 See figures.	1-20, 22-38

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

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"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 November 2002	12 NOV 2002

Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No.. (02) 6285 3929	**SUE THOMAS** Telephone No : (02) 6283 2454

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU02/01416

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2378143 (GENERALE DE TRAVAUX DU BATIMENT) 18 August 1978 See figures.	1-38
X	AU 3504/26 (MILLER) 9 August See figures.	1-20, 22-38
X	US 4615162 (EVANS) 7 October 1986 Se figures.	1-38

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU02/01416

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
AU	16406/00	WO	00/47836
CA	2136778	NIL	
DE	3206163	NIL	
FR	2378143	NIL	
US	4615162	NIL	

END OF ANNEX